Game-Theoretic Models in Distributed Search Systems

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The main topic of this research is the solution of the problem of the qualitative search in INTERNET under implantation of the system OASIS (Open Architecture Server for Information Search and Delivery). With this purpose the game-theoretical model of the interaction of OASIS's servers with each other and with the user is described. The construction of Nash equilibrium and Stakelberg equilibrium suggested as a solution of this task.

The user and servers should act according to one of the described equilibrium.

One of the questions connected with further development and implantation of the system OASIS is the efficient work of all servers of the system. However servers included in OASIS can be controlled by various persons, whose interests not necessary coincide. And the overall performance of each server depends on other systems servers, which are connected to it. Therefore there is a problem of interaction of systems servers among themselves to maximize an overall performance of each server. Here we deal with typical situation which can be described and researched by methods of nonzero-sum game theory, namely with the help of hierarchical games. Hierarchical games model conflict-controlled systems of hierarchical structure. This structure is determined by sequence of control levels ranking in a particular priority order. The results are based on the development under the program INCO-COPERNICUS (project N PL91116).

The problem is formalized as n+1 person game G (Internet user U and OASIS servers 1,2, ..., n) in normal form. And besides we consider a three level conflict-control system functioning as follows. The first control center is fixed. It is the user U placed on the first level of hierarchy. The user chooses which of servers to address and thus selects the following center in the second level of hierarchy. Suppose that the selected server is i. The chosen server i in his turn contacts with n-1 servers of the system standing on the third level of hierarchy, and decides whether to address them or not. The corresponding payoff functions are used and the classes of strategies defined.

As mentioned above the Nash equilibrium solution and Stakelberg solution are found.

REFERENCES

1. A.Patel, L.Petrosjan, W.Rosentiel, *OASIS - distributed search system in Internet*, St.Petrsburg Univ. Press, 1999, pp. 610.